

Reliable Securing



**Best Practice recommendations
for the securing of structures and
equipment at the worksite.**

We wish to thank all contributing DROPS Members, in particular the Reliable Securing Focus Group, for their valuable assistance in the publication of this document.

For further information or details of any DROPS product, including DROPS Membership, DROPS Training, DROPS Workpacks and all DROPS Guidance and Best Practice, please visit our website or contact the DROPS Administration Team:

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Preface

Dropped Objects continue to present significant safety challenges in all operational activities. Our industry's statistical data shows that the majority of high potential incidents can be attributed to dropped objects.

Further investigations show that these challenges relate to a number of contributing factors including work processes, behaviour, design, environment and the inappropriate securing of tools and equipment.

This revised issue of our 'best practice' handbook brings Reliable Securing into the broader context of dropped object prevention and risk management. A fresh approach to the document structure now offers the opportunity to focus on the underlying causes, identify and assess the hazards and apply appropriate preventive and mitigating controls and barriers.

As DROPS expands and gains momentum throughout the upstream energy industry, we acknowledge that our guidance is being reviewed and applied in other sectors - and beyond. **We remind all readers that the guidance and functional recommendations presented in this handbook reflect the consensus of opinion from a cross-section of DROPS global membership.**

DROPS would like to thank SfS and Statoil for taking the initiative to create much of the handbook content and allowing us to freely edit and publish the information.

We extend our thanks to all DROPS members and industry specialists who have taken time to assist and contribute towards this edition. It is all to the benefit of everyone involved in the ongoing fight against dropped objects.

The DROPS Reliable Securing Focus Group

December 2013

*To contact the Group responsible for the publication of this document, please email **admin@dropsonline.org***

*For more details on SfS (Together for Safety) and to access their wide range of safety related resources, please visit **www.samarbeidforsikkerhet.no***

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Introduction

This document is intended to help eliminate the risk of dropped objects. It embraces the requirement for worksite hazard management and illustrates best practice recommendations for Reliable Securing.

The content applies to all personnel, tools, equipment and structures associated with design, supply, transportation, installation, maintenance, operation and dismantlement activities throughout the oil and gas industry.

Reliable Securing is based on an original document produced by Statoil and SfS, in close collaboration with equipment suppliers and users. It's purpose is to disseminate knowledge and best practice to the entire industry.

In many cases, the functional recommendations that are stipulated in this handbook will identify opportunities for improvement. We recognise that it may be impracticable to adhere to all the recommendations, but the content sets a standard we must aspire to.

Should you choose to adopt Reliable Securing best practice, the onus is on you to effectively manage any subsequent changes to existing equipment, systems and working practices. It is important to recognise that the recommendations presented in this document do not replace, supersede or affect any applicable Codes, Standards or OEM Recommendations.

Everyone should use this booklet to understand and establish the necessary barriers to eliminate dropped objects from our industry, but please note:



- **Any modifications made to equipment, tools, structure or working methods - even if they provide a safer solution – will be subject to Management of Change.**
- **Identify Original Equipment Manufacturer (OEM) recommendations with regard to securing – in many cases, appropriate secondary retention methods may be integrated or are available on request.**
- **Identify all associated ownership, maintenance, inspection and certification of equipment, tools and structures.**
- **Always confirm that you have the authority, knowledge, experience and skills to proceed before applying any of the tools or techniques presented in this document.**

What is Reliable Securing?

In simple terms, reliable securing is the appropriate selection, application and management of all fastenings and fixings. To achieve and assure the required levels of performance, these must be designed accurately, installed properly and maintained consistently.

In the context of dropped object prevention, reliable securing provides a safeguard against potential yielding, displacement or failure of fastenings which can lead to equipment or structure falling.

This revised edition of DROPS Reliable Securing goes beyond the fundamentals of bolting and clamping to encompass all opportunities to identify dependable retention methods and technologies that address the risk and barrier-based approach towards safety and environmental excellence.

Reliable Securing reduces the Probability of dropped objects through good design, planning, inspection and application of preventive controls and barriers.

Reliable Securing reduces the Consequences of dropped objects through implementation of appropriate safety securing systems, mitigating practices and processes.

Reliable Securing outlines the key factors that contribute to dropped objects and identifies opportunities to improve hazard identification and risk assessment processes.

Primary Fixings

The primary method by which an item is installed, mounted and secured as to prevent the item falling, eg bolted connections, screws, pins, buckles, clips, welds etc.

Secondary Retention

The engineered method for securing the primary fixing to prevent loss of clamping force or displacement of fastening components, eg locking washers, locking wire, split pins / cotter pins, etc.

Also referred to as Second Barrier or Fail Safe feature in some engineering descriptions.

Note: Double Lock-nutting or Dual Nutting is NOT recommended.

Safety or Secondary Securing

An additional engineered method applied to or around the item and secured back to the main structure, designed to restrain the item should the primary fixing fail, eg rated steel or synthetic nets, baskets, wires, slings etc.

Value Chain Opportunities

We are all exposed to dropped objects at every stage in the value chain shown to the right. We also have the opportunity to introduce improvements at every stage in this chain.

An important goal has been to define barriers that will prevent objects falling. These barriers should be considered in the design, procurement, transportation, use and maintenance of all tools and equipment, particularly where they are used, secured or stored at height.

Design processes accommodate key stages where DROPS best practice processes and technologies can be incorporated.

When procuring, manufacturing and fabricating new assets, tools and equipment, identify and incorporate integrated barriers and safety systems.

This is the fundamental basis for eliminating dropped objects and, as such, all designers, suppliers and buyers must be aware of this requirement.

When modifying equipment and assets or moving to new territories, carefully consider potential dynamic and environmental effects on retention techniques and systems.

Management of Change is essential in maintaining integrity and design intent for all tools, equipment and structure.

When installing new or temporary equipment, always evaluate the risks associated with the chosen location in order to minimise the danger of dropped objects caused by snagging, collision or vibration.

During transportation, apply cargo handling best practice through vigilant inspections and adherence to procedures.

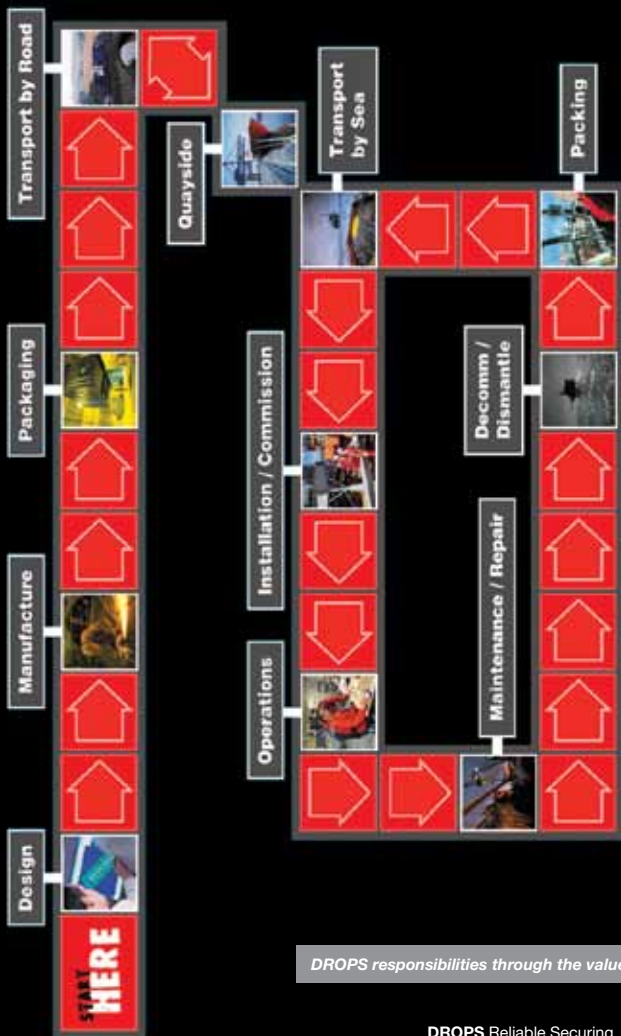
Throughout operational life, always consider the potential for dropped objects caused by poor behaviours, inadequate securing, corrosion, vibration, environmental factors and much more besides.

Above all, be aware that dropped objects happen everywhere. Be sure to identify the potential dropped object hazards in every task.

The Best Practice recommendations set out in this handbook should be complied with throughout the full value chain from engineering design through operational life and with special attention to lifting, work at height and transportation.

By mere conformance with these recommendations you will help us on the path to our goal of zero dropped objects.

Who is Responsible? We all are, everyone in the value chain.



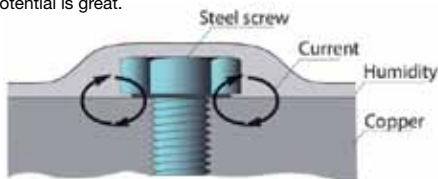
DROPS responsibilities through the value chain

Galvanic Corrosion

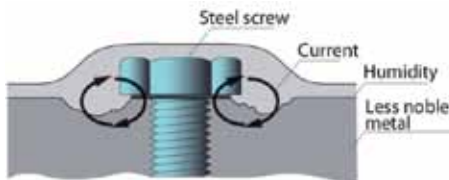
As a basic rule, only metal of the same or almost the same nobility should be combined in a corrosive environment.

Galvanic corrosion occurs when two dissimilar metals with different voltage potentials are in contact with each other in the presence of an electrolyte (damp film or seawater / fresh water). When this happens, the less noble metal becomes the anode and the more noble metal the cathode.

For example, if a steel screw is fixed into a copper plate, the screw will be the anode since copper is the nobler metal. The screw will rust rapidly as the difference in potential is great.

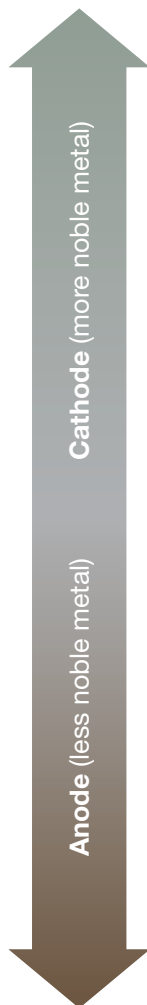


If the same steel screw is fixed into a less noble plate, eg a zinc plate, the screw will be the cathode and will not rust. The zinc plate will corrode, as it is less noble than the screw.



! Always consider the potential for galvanic corrosion where new materials such as passivated stainless steel are introduced.

Certain working environments apply strict controls and guidance with regard to the introduction of alloys. Always check first.



Graphite
Titanium
Silver
Acid-proof steel A4 – passive
Stainless steel A2 – passive
Iconel – passive
Nickel – passive
Silver solder
Monel
Copper/nickel alloys
Bronze
Copper
Brass
Tin
Lead
Tin solder
Cast steel
Steel and iron
Aluminium 2024 – T4
Cadmium
Aluminium 1100
Galvanised steel
Zinc
Magnesium alloys
Magnesium

Bolted Connections

At present, bolts are being produced to at least 85 different industrial standards and the requirements for bolted connections vary for the different sectors depending on design, operational and maintenance requirements.

Achieving a stable bolted connection will therefore require a qualified evaluation of the following factors:

- Load design
- Choice of materials with a view to mechanical properties and corrosion resistance
- Where appropriate, use of lubricant
- Pre-loading (pre-tensioning) and use of the correct torque equipment

The locking of bolts in order to secure against loss of pre-load (tension) is defined as secondary retention. Reasons why so many bolts and bolted connections fail:

Improper use, installation and handling of the bolt	(30%)
Vibrations	(20%)
Knocks	(12%)
Loads (beyond design)	(11%)
Wear	(6%)
Corrosion	(5%)

Source: PSA, 2008



DOUBLE NUT/DUAL NUTTING **- NOT BEST PRACTICE**

Several independent industry tests show that double nut, jam nut or dual nutting arrangements are not reliable methods of securing screwed / bolted connections and are particularly unsuitable for retaining loads in tensioned bolting. The practice of dimpling threads is also inadvisable.



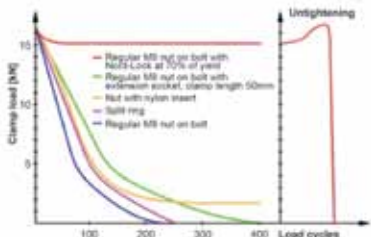
Reliable Securing of Bolted Connections

Flexing of bolted structures and vibration or shock loading in machinery can cause bolted joints to loosen. Thermal cycling may also cause nuts and bolts to become loose.

The majority of bolted connections in the oil and gas industry are subject to dynamic loading in some form. Loose nuts and bolts can lead to joint failure and dropped objects, resulting in avoidable incidents and un-scheduled downtime.

To prevent nuts and bolts from loosening, a reliable, tested and suitably approved secondary retention method should be used. **This is prerequisite where maintaining the clamping force across the bolted connection is critical.**

Note: *Studies undertaken by many independent test organisations over the last forty years prove that many of the older methods of securing bolted joints are not reliable. These methods are now falling out of favour, and may be forbidden by some companies.*



VIBRATION TEST

This graph showing the performance of Nord-Lock products illustrates a typical comparison study of different retention methods.

These tests are designed to replicate anticipated dynamic loading on bolted connections.

To distinguish between bolt types and retention suitability, we have presented the following recommendations in two groups namely bolted connections where clamping force is critical and others where it is not.



To identify and establish the suitability of each bolting method, always consult with the manufacturer, plant owner or operator. For further guidance, consult relevant design and industry codes or standards, or discuss the issue with an industry recognised specialist.

Reliable Securing of Bolted Connections

Here we illustrate secondary retention for tensioned bolted connections, eg nuts and bolts tightened with a suitable tool and typically used for securing of mechanical and structural joints.

The following methods are recommended for mechanical and structural connections where maintaining the **clamping force is critical**.

NORD-LOCK WASHERS

www.nordlock.com

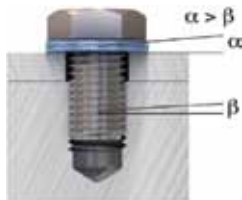
Nord-Lock washers safely secure bolted joints against loosening due to flexing, vibration and shock loading. The system secures bolted joints with tension and not friction, allowing lubrication to aid assembly and maintenance.

They are tested and approved by many independent authorities including Det Norske Veritas and American Bureau of Shipping as well as most leading oil companies. Available in steel, stainless AISI 316L and SMO 254® from stock. Other grades available upon request.

Almost unlimited use in bolted joints where reliable securing or secondary retention is required.



DNV and ABS approved



SAFE-LOCK (SPIRALOCK)

www.spiralock.com

Safe-lock is an all-metal locking nut. The nut has a specially designed threaded profile that locks when tightened and distributes the tension over the whole length of the thread. This provides better load distribution, which in turn helps to improve the locking of the screw connection.

Used for fastening cable support systems.



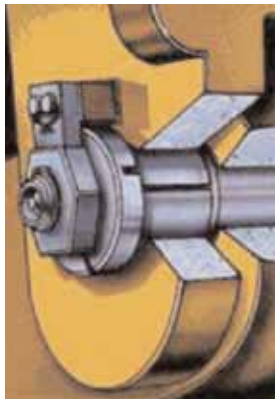
BONDURA BOLT

www.boltnorge.no

BONDURA® has a unique design which uses expanding taper sleeves at both ends of the bolt to eliminate play.

The bolt also prevents play from recurring. Standard screws are used to push in the bolt tapers, and the bolt is fixed directly to the machine component using locking screws. This prevents the bolt from coming loose, falling out or turning in the hole. The bolt can be retightened as the equipment is exposed to wear.

Used on top drives, pipe rack cranes and other pipe-handling equipment.

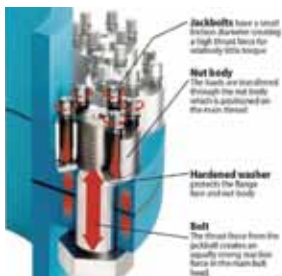


SUPERBOLT

Multi-JackBolt Tensioners (MJT)

www.superbolt.com

Superbolt MJTs are available as nuts or bolts as replacements for conventional bolting elements. They only require hand tools for installation and removal, eliminating requirements for heavy tightening equipment.



Torque is the application of Force that creates Tension in the bolt. **Tension creates a Clamping Force between the two parts.**

Where Clamping Force is critical, consult with manufacturer, relevant design codes or industry specialists to determine the most appropriate retention methods.



Reliable Securing of Bolted Connections

Here we illustrate secondary retention for bolted connections typically used for securing of equipment components and other ancillary items.

The following methods are recommended for bolted connections where maintaining the **clamping force is non-critical**.

NYLON INSERT NUT

Also known as Nyloc, this nut includes a nylon collar insert. The collar deforms elastically as it is applied to the bolt. This increases friction between both sets of threads creating the required purchase for the connection.

A versatile fastening for **non-critical** connections.



Re-use is not advised. May rotate and loosen when exposed to dynamic loading.

METAL LOCKING NUT

Metal locking nuts may be used on all bolt dimensions. This type of nut comes in various forms and may feature a deformed head, split neck or toothed collar ring. Purchase is created by friction, cutting into the thread or contact face. Friction grip relies upon high pre-load and correct torque.

A versatile fastening for **non-critical** connections.



Lubricating the threads may reduce function. May rotate and loosen when exposed to dynamic loading.

CASTLE NUT AND SPLIT PIN

Castellated nuts provide a visual and reliable method for locking bolted connections. Generally used for bolted connections exposed to shear forces rather than tensile stresses. The nut has radial slots and is locked by non-corrosive split pins that are inserted through a hole in the bolt.

Used on connections or components that are disconnected frequently.



- ! **Castellated nut arrangements are not suitable for pre-loaded joints or connections where maintaining the clamping force is critical.**

PALNUT

Palnuts cut into the bolt threads when they are applied and tightened.

Application should be very carefully considered, particularly in areas that are exposed to continuous vibration.



- ! **Not suitable for re-use. May loosen when exposed to dynamic loading. Low-grade palnuts may corrode in marine environments.**

SPRING / SERRATED / TAB WASHERS

There are several types of washers and tab plates - all with different designs and features. Always ensure the correct type has been applied in accordance with equipment manufacturer's guidance / technical support.



- ! **Independent tests have shown that some washer types will loosen when exposed to dynamic loading. All washer selections should be appropriate to the application, environment and the criticality of the connection.**

Locking Wire

Lock / locking wire (also known as indicator wire) should only be applied by competent persons specifically trained in its correct use.

LOCKING WIRE / SAFETY WIRE

Wire locking of bolts is a method adopted from the aviation industry. In brief, the method involves threading a wire through a hole in the bolt to lock it against being rotated loose. The wire is twisted before being threaded and is locked to the next bolt. The wire can be used to lock a maximum of three bolts, as shown in the illustration.

Areas of use:

Used extensively for locking external bolted connections on travelling and pipe-handling equipment, in particular where there are no through-bolts and/or there is a need for simple visual control of the locking.



May stretch, break or corrode if not properly fitted, allowing fastener rotation and loosening when exposed to dynamic loading.



Split Pins / Cotter Pins



A split pin is a metal fastener with two 'tines' that are bent during installation. Also known as a cotter pin or cotter key (USA), these are used to secure other fasteners such as bolts, nuts and clevis pins.

BEST PRACTICE RECOMMENDATIONS:



- Split pins must be bent sufficiently to prevent them from falling out
- Where there is a danger that personnel will be exposed to the sharp ends, the pin must be bent as shown in the image above
- When hoisting personnel or loads, always use 4-Part shackles (bow, pin, nut and split pin)
- Tractor or hitch pins, hairpins, welding rods or home-made pins must not be used
- Split pins should be made of a stainless steel suitable for the operational environment
- Split pins must be inspected regularly and replaced when they no longer function as intended.

! Linch Pins, R-Clips, Spring or Roll Pins, Nappy Pins, or any other type of pin device that can spring or be knocked out should be avoided when used on lifting equipment or for securing of equipment or structure at height. Carefully assess all applications and follow OEM guidance.



LINCH PIN



SPRING PIN



R-CLIP



NAPPY PIN

Securing Devices (Wires, Chains and Connectors)

BEST PRACTICE RECOMMENDATIONS:



- Securing devices must be dimensioned in accordance with the equipment supplier's calculations. The quality of materials used must be consistent throughout the entire assembly
- Only use acid-proof securing wire (AISI 316, type 7x19 IWRC)
- All connectors/snap hooks/carabiners must be made of acid proof steel (AISI 316), include screw lock or self-lock gates and include captive eyes
- Chain must be made of acid-proof (AISI 316) or galvanised steel
- Shackles for use with securing devices should have nuts and split pins
- The length of the securing wire must be as short as possible to minimise the potential fall energy
- Securing devices must be installed, maintained and inspected in accordance with the instructions provided in the supplier's user manual or maintenance instructions
- Ensure devices are suitable for the operation and the environment, with due regard to potential galvanic corrosion
- Where self assembly securing wires are used, these must be assembled and crimped by a competent person
- All securing devices and all attachments to tools and equipment shall be documented and have traceability information. As a minimum this shall include batch marking, the name of the manufacturer/importer, production year, and information about the maximum load / WLL
- In addition, information about the material type, product standard and an installation / maintenance guide must be available.



Always check design ratings of equipment before installing securing devices as integrity may be compromised.

Never re-use securing wires, connectors or chains that have sustained shock loading.



Wherever possible, equipment installed at height shall have integrated secondary retention. Where this is not possible, or where such equipment is exposed to a risk of collision, the equipment must have safety securing in the form of wires or chains and connectors that are securely attached to the structure.

Safety Nets and Meshes

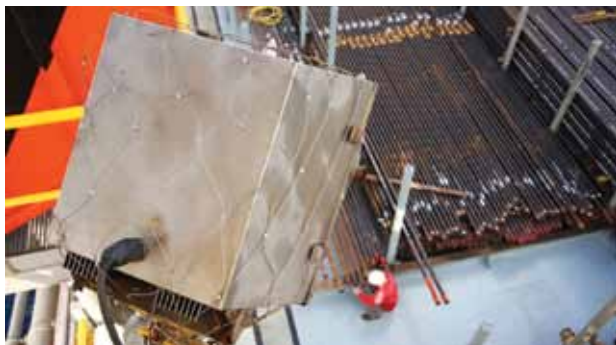
These safety securing devices fully enclose equipment fixed at height that presents a high risk of becoming a dropped object.

Designed to be easily installed, they are particularly well suited to applications where equipment or its components are assessed to be at risk of failure due to factors such as numerous components, design quality, internal or external corrosion, vibration and so on.

BEST PRACTICE RECOMMENDATIONS:



- Always refer to net or mesh manufacturer's recommendations for appropriate selection, installation, maintenance and product life limitations
- Ensure product is suitable for the operation and the environment, with due regard to potential galvanic corrosion
- As with all other safety securing devices, safety nets and meshes should be regularly inspected and replaced if they no longer perform their intended function
- Carefully assess any impact on other activities such as general maintenance access or snagging hazards.



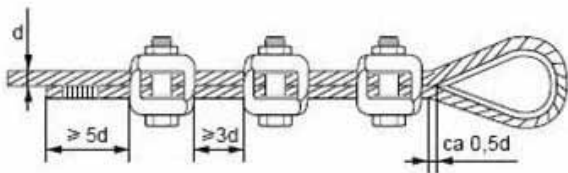
Installation of Wire Clamps

Incorrect installation of wire clamps is a challenge in the industry.

BEST PRACTICE RECOMMENDATIONS:



- Wire clamps must be of the correct number and sized to the dimension of the wire.
- It is a requirement that wire clamps are assembled, inspected and maintained in accordance with the manufacturer's user manual / maintenance instructions
- **Bull-dog style clamps should not be used.**



Correct installation of iron grip wire clamps

Wire rope ϕ		Minimum number of wire clamps
mm	inch	per piece
3-9	1/8-3/8	3
10-16	3/8 - 5/8	4
17-20	5/8 - 3/4	5
21-26	3/4 - 1	6
27-37	1 - 1 1/2	7

Moving catwalk machine, tag line snagged handrail which fell 3m

Using tong head (42kg) as tugging counter-weight, failed; hand fell 6m to rig floor

Section of catwalk machine dropped

18kg

Sling parted choke through hose fell

Tag torque knocked lower

Large dropped scaffolding

Motor (208kg) Nylon strap turbine

Stacking it slipped and kicked to stairwell

Ceiling panel & emergency lighting unit (22kg)

TOP CAUSES OF DROPPED OBJECTS

Safety alerts and incident reports show these recurring themes continue to result in dropped objects:

- 1 Inadequate Risk Assessment** (failure to identify dropped object hazards)
- 2 Human Factors** (operator error, poor behaviour, complacency, neglect)
- 3 Inadequate Procedures** (bad planning, no management of change)
- 4 Failed Fixtures and Fittings** (corrosion, vibration, poor design, selection or improper installation)
- 5 Poor Housekeeping** (pre-existing hazards from previous tasks)
- 6 Collisions and Snagging** (lifting, travelling equipment, tag lines, service loops)
- 7 Inadequate Inspection, Repair and Maintenance** (ignoring unsafe conditions)
- 8 Redundant, Neglected and Home-made Tools and Equipment** (should be eliminated)
- 9 Inadequately Stored or Secured Tools and Equipment** (no lanyards or tethers being used)
- 10 Environmental Factors** (wind, sea motion, ice, snow, extreme conditions)

Dropped Objects also account for significant equipment and environmental damage. Even items that fall into the sea can still carry enough force to cause severe damage to critical subsea infrastructure. Dropped objects are bad for business too, even when nobody gets hurt.

2.2m.

Understanding Dropped Objects

Dropped Objects continue to account for the majority of actual and potentially fatal incidents in the upstream oil and gas industry. In fact, **dropped objects (also known as falling items and material fall)** are among the **Top 3 Causes of death and serious injury across many industrial sectors.** The same statistics apply to leisure activities and home life too.

Concerted campaigns and directives have resulted in better performance within activities such as Drilling and Well Services, but the overall trend shows little sign of improvement.

What is a Dropped Object?

Any item or object that falls or has the potential to fall from its previous position. Unnecessary items, loose items, unsecured items, poorly stacked items, pieces of structure; even entire structures can fall.

Static Dropped Object

Any object that falls from its previous position under its own weight (gravity) without any applied force. For example failure caused by corrosion, vibration or inadequate securing.

Dynamic Dropped Object

Any object that falls from its previous position due to applied force. For example collisions involving travelling equipment or loads, snagging on machinery or stacked items, motion, helicopter downdraft or severe weather.

What Causes Dropped Objects?

A host of factors can contribute to a dropped object incident. It is important to consider these during worksite hazard identification. Energy sources such as gravity, wind, heave and mechanical motion can all contrive to initiate a sequence of events that result in something falling. Add corrosion, lack of awareness and inadequate inspection or maintenance and you can almost guarantee a dropped object will occur.

Statistics show that around 30% of all dropped object incidents are related to design, technical or mechanical issues but almost half can be attributed to human factors. (Source DORIS)

What Should We Do About It?

We cannot simply accept that dropped objects are an inherent hazard of our working environment. A system must be put in place to identify and prevent, and where reasonably practicable, manage the risks associated with dropped objects.

This booklet is designed to help you do just that.

DROPS Calculator

The **DROPS Calculator** (shown opposite) provides a common benchmark in the classification of the potential consequences of a dropped object.

One of a number of similar tools, the **DROPS Calculator** is endorsed by the **DROPS** Workgroup and recognised by the majority of Operators and Contractors in the global oil and gas sector. While other 'calculators' exist, they all follow the same principle – plotting the mass of a dropped object against the distance it falls to determine its possible consequences.

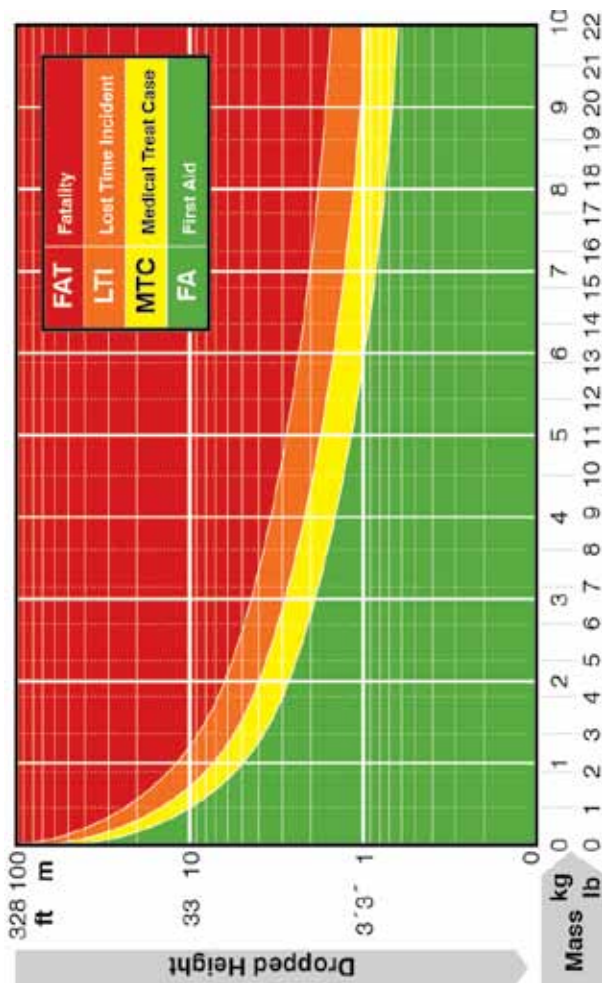
CONSIDERATIONS:



- The calculator assumes a blunt object so is not compatible with broken glass, metal shards etc which may puncture the skin and damage tissue/organic functions
- The wearing of standard PPE, eg hard hat, safety boots and eye protection, is assumed in the calculator
- There is no requirement to subtract the average height of an individual when determining fall distance. The calculation is based on the object striking solid ground. Remember personnel may be crouched or prone, or objects may strike lower parts of the body
- **DROPS Calculator** and other similar tools are guides only providing cursory indication of possible outcome – they are not an accurate prediction
- In reality, even a small object falling from height can be lethal. The heavier the object, the more severe the consequences - the further it falls, the more severe the consequences.

The **DROPS Calculator** is best employed during planning and risk assessment processes. It will determine the potential severity rating of potential dropped object hazards and help with the risk ranking of appropriate corrective actions and control measures.

Electronic versions of the Calculator tool are available at www.dropsonline.org



Responsibilities

GENERAL POLICY

Corporate guidelines and standards should ensure that appropriate inspection and control mechanisms are implemented to identify, assess, eliminate or manage potential dropped object risks. Preventive and mitigating controls should be detailed in specific procedures and instructions such as work at height, lifting operations, control of third party equipment etc.

It is important that we identify and accept our Roles and Responsibilities as set out in these documents.



However, everyone has a responsibility to prevent dropped objects through:

- **Observation and Intervention** (being aware of the hazard, associated risks and prepared to stop work if conditions or actions are unsafe)
- **Reporting** (recording all potential and actual incidents in accordance with company policy)
- **Elimination** (the removal of potential dropped object hazards if it is safe to do so, ensuring all loose items are cleared from the worksite before and after each task)
- **Control** (ensuring all items of structure, equipment and tools are securely fastened or tied off, especially when using tools and equipment at height)
- **Design and Procurement** (informed selection and availability of tools, materials and resources)
- **Inspection** (regular and periodic worksite inspections of all high risk items, particularly loads prior to lifting or transportation).

DISCOURAGED PRACTICES:

DROPS strongly discourage the following methods, techniques and actions:

- Uncertified lifting equipment including 'home-made' lifting devices
- Home-made or customised tools and equipment
- Use of welding rods / wire / tie wraps instead of split pins or safety securing pins
- Use of two part shackles for permanently suspended equipment
- Loaded / tensioned bolts secured with a double nut arrangement
- Unsecured hand tools at height, including grease tubes / guns, water bottles, radios, detectors, pens, phones, etc
- Wire slings tied or wrapped around beams
- Loads left suspended without proper authority
- Use of scaffolding equipment for permanent structures or mountings, including uncertified use of scaffold for lifting equipment
- Leaving fall arrestors un-retracted when not in use.

DESIGN AND PROCUREMENT BEST PRACTICE:

It is widely acknowledged that there are many challenges in selecting and sourcing products and services in each global sector. **DROPS** recommend the following considerations are taken into account:

- Company Policy and Procedures governing dropped object prevention should be understood and communicated to suppliers and partners
- Opportunities to incorporate **DROPS** Reliable Securing Best Practice at each critical design and selection stage should be identified
- All materials and equipment despatched for use in the field must be securely packaged for transportation
- All materials and components should be suitably rated for the operational environment. Where stainless steel is selected, there must be due consideration of the potential for galvanic corrosion
- All items selected for installation or use at height should incorporate appropriate barriers and be readily traced and certified if necessary
- All items secured at height should be situated to reduce or eliminate the risk of damage by snagging or collision
- All Safety Securing devices must include batch marking, manufacturer details and clearly tagged details of maximum load or working load limit
- Suppliers and Partners should be encouraged to support the initiative through active involvement and innovative improvements.

Task Planning and Risk Assessment

At each worksite, potential dropped object hazards must be identified.

Tools, equipment, structures, lights, suspended loads, temporary or portable appliances and any pre-existing loose items will always be a threat. **Effective task planning and risk assessment will reduce the consequences and eliminate exposure to personnel.**

Task Planning and Risk Assessment should include but not be limited to:

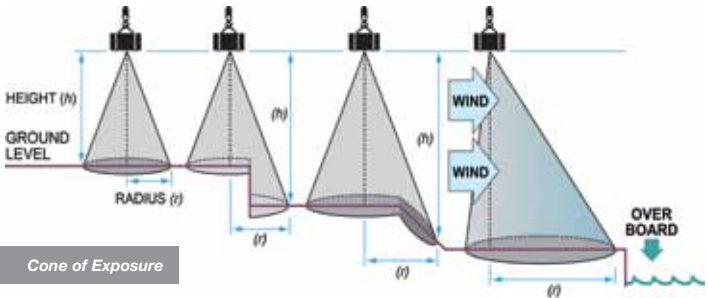
- **Pre and Post Inspections of Worksite** (remember loose items may have been there for years)
- **Load Inspections prior to any lift** (certification, equipment, loose items)
- **Working conditions, equipment and operative's competence** (consider behavioural influences too)
- **Realistic risk-based identification of dropped object hazards** to ensure correct application of controls and resources (as opposed to identification of dropped object hazards in general)
- **Potential path of travel should the identified item drop** (cone of exposure)
- **Understanding each phase of the task**, piece of equipment being employed and the associated hazards and challenges (Operators actions are likely to create scenarios where dropped objects can occur)
- **Effective control of service partner and/or temporary equipment** (be ready to help, not everyone will be familiar with every element of dropped object prevention best practice).

Wherever possible, **eliminate unnecessary dropped object hazards at source.** For those items that remain, carefully assess the likelihood of static or dynamic failure (based on common causes, experience and site-specific alerts) and determine the potential severity should it fall (using the **DROPS** Calculator).

Remember that controls may already be in place (such as procedures, checklists, safety wires etc), so be prepared to identify these and ensure they are adequate. Where new physical controls are recommended, always consider the potential for new dropped object hazards. Mats, covers and nets can fall too.

Additional controls will be subject to **Management of Change** processes.

Consider the potential path that a dropped object may take, deflection, weather factors. Environmental factors, dynamic factors and object shape will affect the shape of the cone. If the Object falls overboard, are there subsea assets or critical infrastructure that may be affected?



ENVIRONMENTAL FACTORS

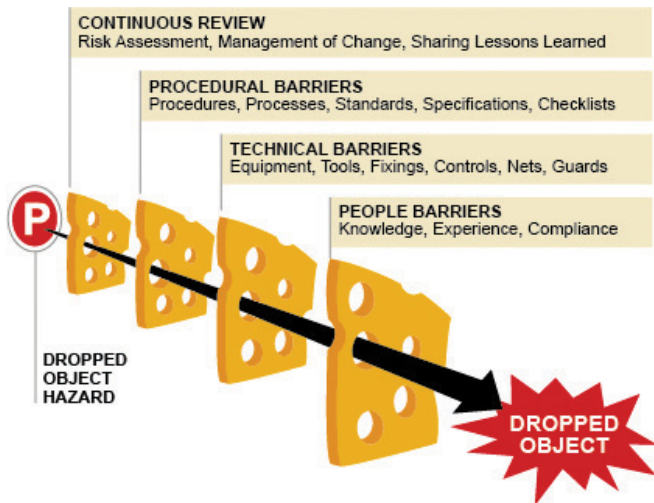
Gravity is an inherent hazard in every workplace. When combined with constant exposure, sea motion and severe weather conditions, the risk of dropped objects increases significantly. During all tasks, particularly lifting and working at height, take special care to identify and mitigate dropped object incidents that can be caused by environmental factors.

- Temperature (cold hands, sweaty hands, materials perishing)
- Winds and Helicopter Downdrafts (box lids, doors, signage, meteorological equipment, stacked items)
- Sea Motion (stacked items, shelving, loose items, suspended items)
- Ice and Snow (icicles, ice build-up, hard packed snow – can also obscure loose items)
- Rain (accumulations in buckets and vessels can add significant weight)
- Mud and Sand (can add weight but also obscures loose items, particularly on cargo units)

Fog, poor light, sun light, darkness can also become contributing factors when vision is critical to safe operations.

Preventive and Mitigating Barriers (Controls)

Barriers are functions and measures designed to break a specified undesirable chain of events. In other words, their function is to prevent a hazard, such as a dropped object, from manifesting itself or to mitigate the consequences by breaking an undesirable chain of events.



These are our barriers to prevent dropped objects. We need them all to be synchronised for our barriers to function.

In managing dropped object risk, we first identify and ensure that our preventive barriers are in place. These will reduce the likelihood that an incident will occur. Where we consider the risk that these preventive barriers will fail, we put mitigating barriers in place to reduce the likelihood that an incident will reach its full potential.

We describe some of these in a little more detail, and where applicable make reference to other sections within this booklet.

INDEPENDENT SURVEYS AND INSPECTIONS

Independent Surveys are typically carried out annually and are expected to identify all potential dropped object hazards and, where possible, assist with the removal of any unnecessary or redundant equipment.

The Independent Survey Specialist will provide a Survey Report, presented by areas and zones. Failed Items are reported to the asset management team. An Inspection Book, based on the Survey is then presented to the asset team for their daily, weekly and periodic inspections.

Inspection programmes should cover the entire Facility / Installation and inspection periods must be determined based on likelihood and potential consequence of dropped objects.

Inspection Books are regularly updated to reflect any changes in equipment and conditions. Third Party and temporary equipment should also be incorporated within the system.



Dropped Object Survey and Inspections are provided in many different formats, including integrated electronic systems.

Further information on DROPS Surveys can be found at www.dropsonline.org under the heading Guidance Documents and Best Practices.

SECURING OF TOOLS AND EQUIPMENT

See Best Practice Recommendations in this booklet (Pages 46-53)

COLLISION CHECKLISTS

A Collision Checklist should be developed and available at each Equipment Control Station. Before starting a task where equipment will be moved, the equipment operator must review the appropriate Collision Checklist for obstructions that may result in a dynamic dropped object.

For example, a Crane Operator's Collision Checklist would include any equipment that the boom could collide with during a lifting operation.

Operator's Collision Check List	
Port Crane	
12-18m / 40-60ft Radius	<input type="checkbox"/> Drill Floor Stairs
18-24m / 60-80ft Radius	<input type="checkbox"/> Derrick
	<input type="checkbox"/> Gantry Crane
	<input type="checkbox"/> Port Flare Boom
24-38m / 80-125ft Radius	<input type="checkbox"/> Derrick
	<input type="checkbox"/> Gantry Crane
	<input type="checkbox"/> Port Flare Boom
	<input type="checkbox"/> Catwalk
	<input type="checkbox"/> Aft Lifeboats
	<input type="checkbox"/> Accommodation Block
	<input type="checkbox"/> Accommodation Stairs
	<input type="checkbox"/> Communications Mast

DROPPED OBJECT AWARENESS

All personnel should demonstrate a basic understanding of dropped object hazards and the need to comply with all dropped object prevention policies and processes. Training, familiarisation and on-the-job coaching is key to achieving this.

These are the key objectives of a dropped object awareness programme:

- **Identifying and assessing potential hazards**, their causes and consequences (observation and reporting)
- **Understanding the methods** for control and prevention (task risk assessment)
- **Recognising personal responsibilities** (compliance, intervention and improvement).

Further training in use of Tools at Height systems, Working at Height, selection and application of safety securing devices and other methods should be made available as appropriate.

PERSONAL PROTECTIVE EQUIPMENT

Standard workplace PPE offers limited protection against falling objects. Ensure that all equipment is appropriate for the task and certified for use.

Anyone using personal protective equipment against falls from heights must have documented training.

HOUSEKEEPING

Items that are not in use or not in service are often excluded from established inspection and maintenance procedures and present considerable risk potential. Tools and equipment, redundant machinery, scaffolding components and other loose materials left from previous works regularly feature in dropped object reports.

Before work starts and when the work is complete, a full check must be carried out to ensure that no loose material or equipment has been left, especially at height.



TIME OUT FOR SAFETY

There are many variations on the theme, but the principle is always the same. Everyone has the authority to stop work - but we don't have to wait for an unsafe act or condition to arise before we do. **Take Time Out to discuss potential dropped objects at the worksite.**

Share experiences and learn from recent alerts and incidents – use this knowledge during task risk assessments. Discuss changes in the environment and how they might affect equipment and structures around you. Plan your Time Out sessions around your task, providing opportunities to review hazards and check that controls are still in place.



SECONDARY/SAFETY SECURING SYSTEMS

Wherever possible, equipment installed at height shall have integrated secondary retention. Where this is not possible, or where such equipment is exposed to a risk of collision the equipment must have additional secondary or safety securing in the form of wires or chains and connectors that are securely attached to the main structure.

Best Practice Recommendations are detailed in this booklet.

SAFETY MEETINGS AND AUDITS

DROPS encourages regular dropped object management meetings to be held at worksites to discuss observations, incidents, survey and inspection reports, recent industry alerts and any improvements that could be made in dropped object prevention performance.

Focal Points and Subject Matter Experts can be assigned to engage with personnel, ensuring preventive measures are functioning and that Third Party or temporary equipment has been considered and included.

Worksite Dropped Object Prevention Committees or Working Groups may be established to regularly discuss performance, incident reports, lessons learned, best practice and new techniques or tools available on the market. **DROPS** recommend that all service partners are included in such groups.

RESTRICTED ACCESS AREAS

If a potential for dropped objects has been identified during Risk Assessment, barriers must be placed to prevent unauthorised access to the work site.

Set up barriers beneath the work area and ensure the extent of the barriered zone is appropriate to the work height with consideration to the potential path that a dropped object may take (eg deflection and weather factors).

Ensure that access and egress to the barriered area is clearly marked including details of work being conducted. In the case where emergency evacuation routes are affected place signs marking another safe route.

If the potential area prevents effective use of barrier chain and signage, consider using frequent PA Warnings and standby persons preventing area access.

Ensure that you consult with your Company Policy on Barrier philosophies, procedures and work practices.

PREVENTIVE MAINTENANCE *(also Planned or Condition Based Maintenance)*

The primary goal of Preventive Maintenance is to preserve and restore equipment reliability by replacing worn components before they actually fail. Preventive maintenance activities include partial or complete overhauls at specified periods.

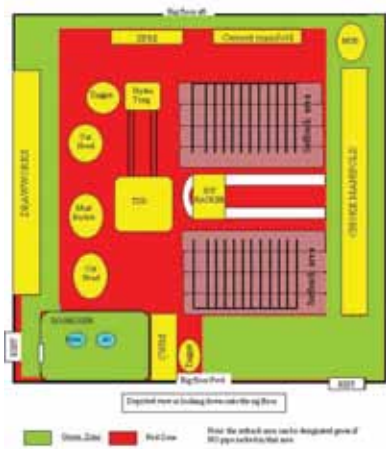
In addition, equipment deterioration can be recorded so that worn parts can be repaired or replaced before they cause system failure. The ideal preventive maintenance programme would prevent all equipment failure before it occurs.

'DROPS' RED ZONES

Areas where personnel may be exposed to dropped object hazards may be classified as DROPS RED ZONES. All personnel in this Zone must be required for the current operation and must be authorised by the Area Authority.

The Area Authority must also ensure that all personnel entering a DROPS Red Zone are aware of the hazards and ensure an appropriate plan is in place for specific operations.

All personnel working under authority within a DROPS Red Zone must have a specific responsibility during the task, understand the placement of personnel, and be aware of machinery which may be operated during the task and identify safe 'Step Back' zones during high risk activities such as lifting or movement of machinery above. This offers opportunities to consider reducing or even eliminating time spent in the DROPS Red Zone.



DROPS Red Zones are unique to each worksite.

Drill Floors, Moon Pools, Pipe Laydown and many other areas where there is a high risk for dropped objects may be designated as DROPS Red Zones.

These Zones are highly visible and may include colour coded barriers, walkways and floor coverings.

Typical DROPS Red Zone



The term 'Red Zone' may already be employed in working areas such as drill floors where rotating machinery is a hazard.

To avoid any confusion with 'DROPS' Red Zones, refer to your worksite hazard management systems for further guidance.

General Tips for Dropped Object Free Worksites

Before starting any task, consider the potential for dropped objects. Even if your task is not at height, consider the environment where you will perform the task and any other activities that may be going on around you.

Pay particular attention to **environmental factors** such as wind, sea motion, light, downdrafts etc.

Before commencing the task, visually inspect the work area for **pre-existing dropped object hazards** such as loose items and debris.

Check all equipment and structures in the area to **ensure that all fastenings, bolting, covers, panels, hatches, removable guardrails etc are properly secured.**

Check all safety securing features are in place (split pins, locking wire, locking washers).


Pay particular attention to lighting and other fixtures that may not be secure or present a **snagging / collision** hazard.

Look out for moving machinery and corroded brackets and structure.

Identify existing controls are in place such as toe-boards, guards, barriers, communications etc.

Also consider the following:

- Inspect all **Tools and Equipment** (certification, damage, securing points, lanyards, tool bags)
- Identify **Dynamic Potential** (collision, snagging, movement, load-shift)
- Identify **Dropped Object Scenarios** (discuss during tool box talks, take regular time-outs to re-evaluate)
- **Remove loose items from pockets** (tools, radios, detectors, water bottles) and secure them properly.

 **Identify and assess energy sources that can cause dropped objects.**

Gravity, Motion, Mechanical Movement, electrical or pressurised equipment, vibration – even temperature can cause dropped objects. Cold hands can lead to loss of grip on rails, ladders, etc.

Securing Equipment During Severe Weather

BEST PRACTICE RECOMMENDATIONS:



- Structures and equipment should be designed so that water cannot collect and form ice
- Establish routines for inspection before, during and after adverse weather conditions, such as strong winds, high waves, and the risk of ice / falling ice
- Use available time during shift changes to carry out an extra check of equipment that may loosen
- Check whether the workplace is clean and tidy. Equipment stored on deck and in other areas may be blown over by the wind or downdrafts, so check the securing devices
- Check windsocks, wind sensors, floodlights, antennas, antenna masts and scaffolding
- Carefully check that equipment in the vicinity of the helideck is sufficiently secured
- Check for any loose objects on roofs, load carriers and in all storage areas
- Check that the lids of storage boxes are secured.



Observation Techniques

Identification, assessment and risk ranking of findings will address opportunities to eliminate or manage potential dropped objects. Regular Hazard Hunts can be implemented, raising awareness whilst making the worksite a safer place.

BEST PRACTICE RECOMMENDATIONS:



- Set aside time and limit the area to be inspected
- Concentrate on categories of potential items (eg loose material, panels, lighting, corroded structure etc) and establish how these are secured and if they require removal or repair
- Findings that do not conform to Best Practice and cannot be immediately rectified safely should be reported to the Area Authority. To assist in risk ranking, include description of item and area, potential consequence if it were to fall (DROPS Calculator), possible causes (corrosion, collision etc) and if appropriate suggested recommendations for remedial action
- Follow up on all items reported. Corrective action is after all a decisive factor in preventing dropped objects.

IMPORTANT CONSIDERATIONS:

- Involve everyone in this process, a fresh pair of eyes can be beneficial
- Ensure all 'hunters' have secured all personal equipment and that bags or containers are available for appropriate collection and disposal of debris
- Advise the importance of accurately reporting location of any items that may appear to be integral components of equipment or its fixings (eg bearings, bolts, brackets). This may be an early warning sign of a potential failure.

Unnecessary Equipment at Height

DROPS recommend that all tools AND equipment are carefully assessed for suitability for use at height. Many cases have been reported where redundant or unnecessary equipment has been left at height presenting significant hazards to personnel and plant below.

BEST PRACTICE RECOMMENDATIONS:



- Always anticipate unidentified legacy hazards (eg shipyard tools, construction debris, scaffold clamps etc)
- Record all construction, maintenance and repair materials taken aloft. Ensure all material removed or not required is taken down safely
- Regularly carry out a risk assessment and review of what equipment is required at height, and what should be removed
- The review should establish whether equipment should be relocated to reduce the risk of collision with mobile equipment
- Inspection and maintenance procedures should be revised regularly, to ensure inspection and maintenance of all equipment installed at height
- Always carry out a final check to ensure that no tools, equipment or materials are left behind at height.



Post Inspection / Final Check Of The Worksite

Experience shows that a clean and tidy workplace is less exposed to dropped object risk than an untidy or poorly managed work area.

On facilities and installations with rotations and shift work, this effect is intensified by the fact that we are also exposed to other people's "clutter".

It is therefore extremely important that we have good routines for final checks of the worksite.

BEST PRACTICE RECOMMENDATIONS:



- Always keep your worksite tidy, even small items can create unnecessary hazards
- Tools, equipment and materials must be secured in a safe location at the end of each shift
- When the work is finished, a final check and inventory count must be carried out to ensure that no tools, equipment or materials are left behind at height
- Check that all equipment is installed, secured and returned to normal operation (eg replace locking wire, close and secure latches)
- The worksite must be left in a clean and tidy state, and all tools, equipment and materials must be returned to their designated storage places
- Loose objects at height must be removed, attached or secured
- On mobile units, a risk assessment must be carried out to determine whether equipment on work benches, shelving and racking shall also be secured.

Workplace Best Practice

Work operations often involve work at height. Many operations therefore contain an element of risk as:

- You are exposed to work or equipment above you
- Personnel below you are exposed to your work
- You are working at height and could fall

In the remaining part of this booklet, we distinguish between the securing of personnel working at height, the securing of permanent equipment, and the securing of tools and parts that are used at height during a work operation.

Ideally, all work should be carried out on the ground or at a level where all edges and openings can be secured to prevent persons or objects falling to a lower level. Where there is a requirement to work at height, you must refer to your Employer's Work at Height Policy and Procedures.

These procedures will ensure compliance with relevant legislation on securing of personnel, erection of working platforms, over-the-side work, ladders, hoists, tools and other devices. Other key considerations such as access control, safety equipment and rescue plans will also be covered.

However, dropped objects caused by failure to secure tools and equipment continue to happen whilst they are being carried to the worksite, used or stored at height. This includes radios, detectors, pens, gauges, hard hats, water bottles and many other personal items that really should be secured properly – or not taken aloft in the first place.



Remember, if the task cannot be undertaken at ground level and you must work at height, refer immediately to your Employers Work at Height Policy or ask your supervisor for assistance.

Securing of Personnel

Common Causes of Incidents: Complacency, Incompetence, Lack of Supervision, Uncertified or Damaged Fall Arrest Equipment, Operator Error, Poor Communication, Snagging and Collisions, Environmental Factors.

BEST PRACTICE RECOMMENDATIONS:



- The choice of equipment to be used must be made after evaluating the work place environment
- Established control procedures must be followed before, during and after use
- Anyone using personal protective equipment against falls from height must have documented training (including rescue method training)
- Nobody shall work alone or unattended when using fall arrest equipment
- Everyone involved in the work scope must have sufficient training and awareness of the equipment and safety procedures
- A 'Buddy' check of all fall arrest, rigging and other equipment must be carried out
- The necessary rescue equipment and trained personnel must always be available at the workplace
- Fall arrest equipment must have CE approval, incorporate an anti-trauma safety device and comply with an accepted standard
- The equipment shall be checked EVERY TIME before use and must be checked at least every 6 months by a competent person
- The date for next inspection must be clearly shown on the equipment
- The anchor point for suspension must be rated to 5000 lbs (22kN) - OSHA.



Derrick Evacuation Equipment

Far too many defects have come to light in evacuation equipment. In many cases there is deficient certification, control and labelling of harnesses and blocks (brakes).

BEST PRACTICE RECOMMENDATIONS:



- Riding belts and blocks must be certified, controlled / inspected and labelled in line with other anti-fall equipment
- The guide line, its attachment points and connectors are also defined as anti-fall equipment and must be certified, controlled / inspected and labelled accordingly
- Riding belts must be connected to guide lines and blocks and stored so as to protect them from wear and tear / damage from external factors
- It must be possible to use the equipment for the safe performance of entry and evacuation operations
- The equipment must be checked every 6 months by a competent person and shall be marked with the next inspection date.



Ensure evacuation equipment boxes are secured and that lids and catches are in good condition. Remove unnecessary items that may have been left in boxes.



Securing Tools <5kg / 11lbs

Common Causes of Incidents: Improper Use, Home-made tools, Incorrect Securing, Operator Error, Snagging and Collisions, Environmental Factors (eg cold hands).

BEST PRACTICE RECOMMENDATIONS:



- All use of tools at height must be risk assessed
- All tools shall be secured against being dropped whilst they are being carried to the worksite, used or stored at height (use tool bag with internal loops when several and / or heavy tools are required)
- If an anchor point other than the belt or bag is required, use an appropriate part of the surrounding structure, preferably above the work level
- Tools heavier than 2kg / 4.5lbs should not be secured to the body, secure them to the adjacent worksite structure
- For work on or near rotating machines or travelling equipment, all tools should always be secured to the adjacent structure
- Attachment points / devices on tools and bags must be documentable (not all apertures on handles are actually rated tie-off points)
- All connectors/snap hooks/carabiners must be made of acid proof steel (AISI 316), include screw lock or self-lock gates and include captive eyes (see also Page 18)
- Lanyards on tools attached to the body should ideally be energy-absorbing (fall damper)
- The standard use of wrist lanyards is discouraged, however, it is recognised that they may be appropriate to specific tasks, eg within confined spaces
- Velcro wrist lanyards are discouraged as the integrity of the fastening can be affected by the work environment
- Tools used at height should be checked out / in (see Page 54) in a Log Book to ensure that nothing is left behind.



! Lanyard attachment points (moveable, spring clip or fixed) should be selected according to size and weight of tool.

Securing Tools >5kg / 11lbs

Common Causes of Incidents: Poor Risk Assessment, Improper Use, Home-made tools, Incorrect Securing, Operator Error, Snagging and Collisions, Environmental Factors (cold hands!).

BEST PRACTICE RECOMMENDATIONS:



- All use of heavy tools and hand-held machinery where equipment may fall to an underlying level must be risk assessed
- All heavy tools and hand-held machinery used at height must be secured against being dropped, both when in use and while being transported
- Securing points for tools and machinery must be in place above the work site, attached to the surrounding structure, not to scaffolding
- Tools heavier than 2kg should not be secured to the body, secure them to the adjacent worksite structure
- One piece sledge hammers (forged construction with secured head) should be used at height
- The attachment points / devices on tools shall be documented and all securing wires inspected in accordance with the manufacturers recommendations
- The securing wire must be as short as possible to reduce shock loading effect
- Energy absorbing lanyards and tethers can stretch beyond the safe calculations or drop distance, therefore fixed securing wires should be used on heavy tools at height, according to the work environment
- Only certified lifting equipment shall be used as securing devices (where appropriate)
- Tools used at height should be checked out / in (see Page 54) to ensure that nothing is left behind.



Securing Other Portable Equipment

There have been several incidents reported where portable equipment such as radios, gas detectors and digital cameras have been dropped from height.

BEST PRACTICE RECOMMENDATIONS:



- All portable equipment used where there is a risk of the equipment falling to an underlying level must be secured against being dropped
- Carrying pouches must always be used for radios and any other portable equipment without certified securing points
- Locks on pouches must have a double securing mechanism to prevent unintentional opening
- Belt clips that allow equipment to become detached when turned 180° should not be used
- Belts with snap fasteners are not suitable for securing equipment at height
- Battery compartments and covers on portable equipment must be secured to prevent internal components from falling.



Remember even small items falling from significant heights can cause injury and distractions. Ensure all personal equipment (tally books, pens, callipers, cameras, water bottles etc) is secure in a fastened pocket or carry pouch.

If the item is not required for the task, do not carry it at height - leave it at ground level.



Securing Equipment and Parts

There have been a significant number of loose items, other than tools left at height following repair and maintenance tasks. Consider every item carried aloft as a potential dropped object – and ensure that all material is removed from the worksite on completion.

BEST PRACTICE RECOMMENDATIONS:



- All equipment used where there is a risk of the equipment falling to an underlying level must be secured against being dropped
- All repairs and maintenance work carried out at height must be risk assessed
- All parts, equipment and materials that are worked with at height must be secured against being dropped
- Smaller parts must be stored in suitable storage boxes, bags, etc
- In restricted areas, such as the derrick, flare boom and cranes, tools used at height must be logged out and in to ensure that nothing is left behind
- When the work is finished, a final check and inventory count must be carried out to ensure that no tools, equipment or materials are left behind at height.



Tool Cabinets for Work at Height

Tool cabinets for work at height are now readily available and employed on many facilities. Unfortunately, a number of irregularities have been observed regarding securing, control and registration of tools.

BEST PRACTICE RECOMMENDATIONS:



- All tools stored in high cabinets must be appropriate for use at height and they must have documented attachment points
- All tools must be adequately secured within the cabinets
- In addition to the necessary tools, cabinets must be equipped with:
 - a sufficient number of correctly dimensioned safety wires / lanyards
 - a sufficient number of connectors / snap hooks / carbine hooks with screw lock and eyelet
 - special belts for fastening tools and bag
 - a sufficient number of tool bags with internal fastening devices
 - weak links / weak link systems (where required)
- Each cabinet must have a list of certified and traceable contents and be kept locked, and one person must be designated as responsible for the cabinet
- The responsible person must register all tools taken from and returned to the cabinet. The contents of the cabinet and the log shall be checked at the end of every shift.



Hoisting, Lifting and Suspended Items

On and within our facilities, there is a wide range of fixed and temporary hoisting and lifting devices, all of which should comply with standard industry legislation and best practice.

DROPS recommend it is best practice to afford all suspended items the same considerations as for hoisting and lifting equipment, ensuring appropriate certification, inspection and maintenance management is applied.

The following equipment should be considered as suspended items and should be recorded in the lifting equipment register and inspected regularly:

- Counter weights and other suspended compensating devices
- Bunkering hoses, tow bridles and other equipment over the side
- Halyards and other flag hoisting devices
- Temporary suspension for wireline or coiled tubing equipment.

A complete register of all lifting equipment used to hoist, lift or suspend such items shall be available to record data on all lifting equipment and its certification status, including ID number, WLL (SWL) and date into service. The register shall include items such as slings, shackles, pad eyes, trolley beams, hoists, lifting caps, lifting attachments or devices.

It is important to incorporate all these items within any dropped object survey and inspection management system. Inspection criteria is likely to include:

- Check arrangement of suspension equipment is in accordance with lifting and hoisting best practice
- Check certification and test (current colour code)
- Check general quality of components (fatigue, corrosion)
- Check application of clamps (correct sizing and fitting)
- Check all shackles are complete with safety securing (split pin / cotter pin)
- Check appropriate authority has been granted for all loads left suspended.

All personnel lifting equipment and activities shall comply with Industry and Corporate Standards for Personnel Lifting.

All other equipment such as forklifts, elevators, mobile platforms etc shall be maintained and operated in accordance with current legislation.



HOME-MADE LIFTING DEVICE

- Uncertified equipment (inc shackle)
- Sling doubled back
- Incorrect application of clamps
- Potential for snagging

POOR CLAMP SELECTION

- Incorrect sizing
- Possible fatigue/corrosion

Bunkering Hose Suspension - Not Best Practice

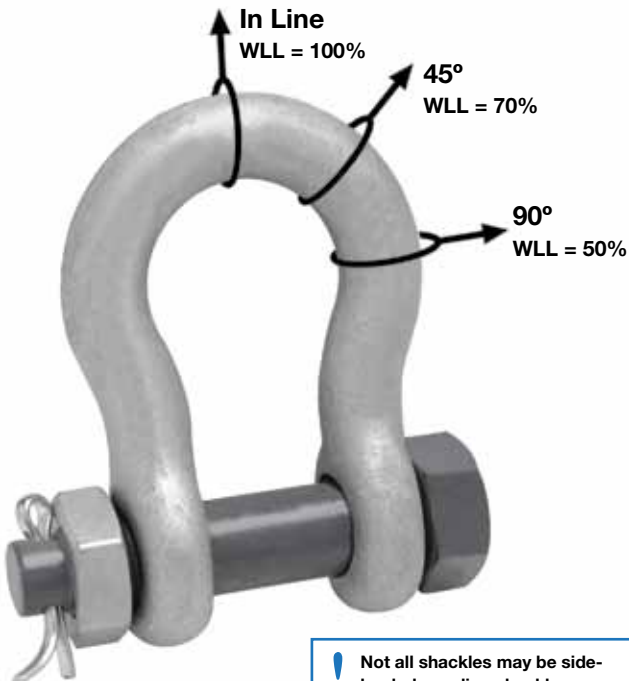
Correct Use of Shackles

Shackles are used in lifting and static suspended systems as removable links to connect wire rope, chain and other fittings.

BEST PRACTICE RECOMMENDATIONS:



- Shackles must be of an adequate WLL (SWL), certified and approved, ie designated with the current colour code
- 4-Part Shackles (Safety Bolt type) must be equipped with two barriers: nut and stainless steel split pin / cotter pin
- Split pins / cotter pins should be sufficiently splayed to prevent them from being knocked out or causing injury
- Linch pins, nappy pins or R-Clips should not be used during lifting as these may be knocked out or cause snagging (also see Page 17)
- 2-Part Shackles (Screw Pin or Round Pin type) should never be used for permanent suspension or in any application where the pin can roll under load and unscrew
- Shackles must only be used for their intended purpose and manner
- The user must be familiar with the applicable limitations and guidelines for use (always refer to manufacturer's data sheet)
- Shackles are designed to support the load at the bottom of the hollow torus and evenly across the shackle bolt
- If shackles are exposed to loads in other places, this must be taken into account during use as it will reduce capacity
- Where point loading is unavoidable, ensure load is reasonably centred, never load shackle pin to shackle pin and refer to manufacturers guidance for further details
- Side loading of shackles should always be avoided as this reduces the WLL factor. If it is completely unavoidable then the figure opposite may be used as guidance although manufacturers' guidance may differ.



- ! Not all shackles may be side-loaded, eg sling shackles.

Always refer to manufacturer's technical data sheets for loading and operational limitations.

- ! Split pins / cotter pins should be of the correct length.

Ensure pins are properly splayed (as shown here) to reduce the risk of snagging and injury.

Sheaves and Snatch Blocks

The **DROPS** Reliable Securing Focus Group has, through co-operation within the industry and with appropriate support and guidance from product manufacturers, studied best practice for securing of permanent and temporary sheaves and snatch blocks at height.

There has been an industry trend toward the application of additional safety securing devices on blocks and designers and manufacturers have responded accordingly.

In all cases, **DROPS** recommends that the following considerations are assessed before installing any additional securing wires or devices on sheaves and snatch blocks suspended at height:

- Potential failure factors (eg lack of maintenance, overloading, component failure etc) resulting in multiple parts falling
- OEM (Original Equipment Manufacturer) recommendations for suspension and use of equipment
- Design and engineering criteria for load bearing structure
- Inspection and Maintenance programmes and frequencies (OEM recommended or increased)
- Suspension shaft and head fitting design features (integrated primary and secondary retention)
- Integral component securing (eg caps, greasing points, guards etc)
- Integral engineered securing points (eg appropriate application and rating of securing points).

Further to this, assess the implications of installing an additional device:

- OEM recommendations (some do not favour the application of additional securing devices)
- Securing device WLL (SWL) rating (including shock loading considerations)
- Positioning of additional safety securing points (or point sharing / criss-crossing of safety securing wires)
- Safety concerns with regard to snagging (where additional safety securing has been added)
- Inspection and Maintenance of additional safety securing devices (Management of Change).

DEFINITIONS

Sheave Block:

An assembly consisting of a pulley wheel, side plates, shaft and bearings over which a cable or rope is passed.

Snatch Block:

A block that can be opened on one side to receive the looped part of a rope or a block that can be opened so that a rope can be inserted from the side, without threading it through from the end - so called because the rope can be inserted quickly: figuratively, the block snatches it.



Sheave and Snatch Block Securing

BEST PRACTICE RECOMMENDATIONS:



- Always refer to Original Equipment Manufacturer (OEM) recommendations and guidance. All engineering design, technical and operational limitations data should be consulted
- Blocks must have two integrated barriers (primary and secondary retention) in both the suspension and the shaft
- A maintenance programme must be established in accordance with the manufacturer's user manual. It is a requirement that blocks, shackles and lifting lugs must be inspected at least every twelve months by a competent person. This must be documented
- Load bearing assemblies (eg snatch blocks) should be of the type that can be totally disassembled for detailed inspection of every load bearing component
- Blocks must be dismantled at the request of the competent person or in accordance with the manufacturer's recommendations, and at least every five years
- All blocks and suspension shackles should be marked with the designated colour code
- For statically installed or semi-permanent installation a sheave block should be used
- Head fittings must have manufacturers primary (forged / machined / threaded) securing and manufacturers secondary (forged / manufacturers welding / split pin) securing.
- Sheave shaft must have manufacturers primary (machined / threaded) securing and secondary retention (weld / split pin) as designed and incorporated by the manufacturer.

NOTE: Where R-clips are supplied these should be replaced with a split pin

- Side plates shall contain / enclose / en-capture the block should a centre pin failure occur, and catch the line in the event it jumps the sheave. Side plates that open shall be secured when open.

BEST PRACTICE RECOMMENDATIONS (continued):

- Roller bearings shall be used on the sheave shaft / centre pin – bronze type bushing shall not be used
- Only split pins shall be used, R-Clip type pins or nappy type pins shall not be used
- Only 4-Part shackles (bow, pin, nut and split pin) shall be used for the suspension of the sheave blocks, these must be equal to or greater than the Safe Working Load of the head fitting
- Grease / lubrication lines should be fitted as required by the manufacturer to lubrication points. All caps and covers shall incorporate safety securing such as locking wire.

DROPS advise the following considerations for sheave and snatch blocks that do not have integral safety securing as designed by the manufacturer.

The purpose of the additional secondary securing is to arrest the fall of the block components should a head fitting or sheave centre shaft failure occur. It may not be practicable to install secondary securing devices to arrest the fall of a block arrangement caused by overloading.

BEST PRACTICE RECOMMENDATIONS:



- Secondary securing slings shall be equal to or greater than the Safe Working Load of the head fitting of the sheave / snatch block
- Secondary securing slings shall be secured to an independent fixture point from the sheave / snatch block
- Secondary securing slings shall be certified and colour coded with the current colour code
- Secondary securing slings shall not interfere with the operation and movement of the sheave / snatch block
- Only 4-Part shackles (bow, pin, nut and split pin) shall be used to attach the secondary securing sling and these must be equal to or greater than the Safe Working Load of the head fitting.

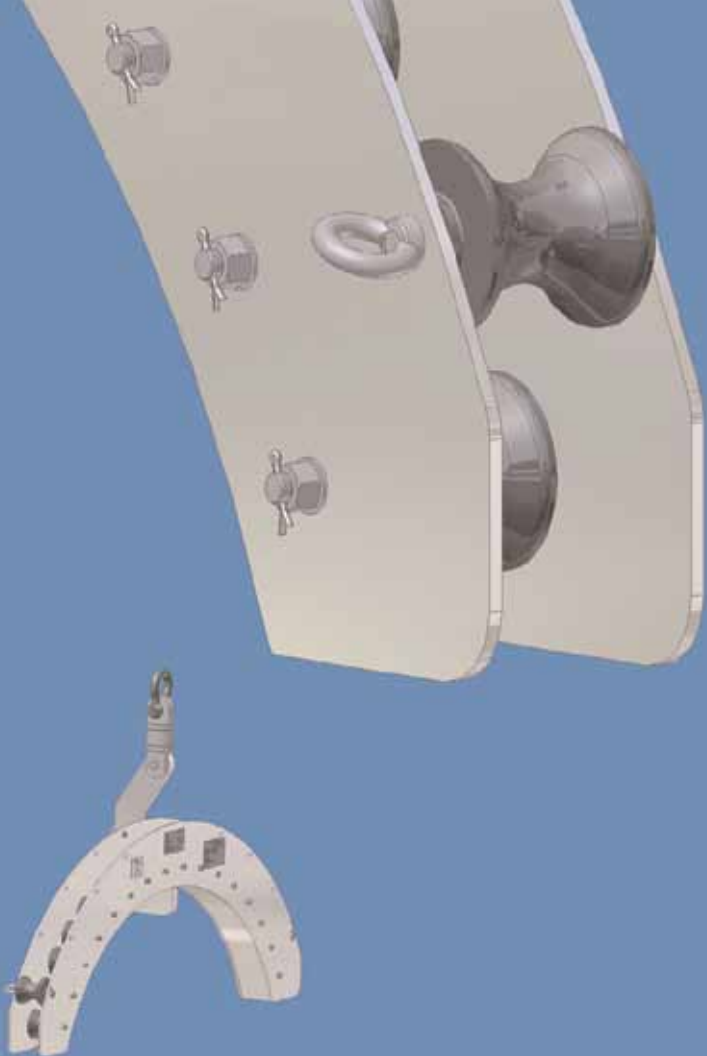
Umbilical Roller Sheaves

An umbilical roller sheave is a sheave which is designed to hold and accommodate an umbilical at its dynamic minimum bend radius. These sheaves have many constituent parts which include nuts and bolts, rollers, side plates and swivel. As a result of inadequate securing, there have been several serious incidents where these parts have worked loose and fallen to the deck below.

BEST PRACTICE RECOMMENDATIONS:



- Umbilical roller sheaves must be suspended / secured with two independent barriers. The preferred solution is to use through bolts / pins with locking nuts and split pins
- Rollers must be secured with two independent barriers. The preferred solution is to use through bolts with locking nuts and split pins
- The umbilical roller sheave must be used exclusively for the purpose for which it was intended ie not for suspending wires.
- The umbilical roller sheave must have its own maintenance programme and be subject to annual testing and inspection in accordance with manufacturer's guidelines
- User manuals / instructions must provide guidelines for the correct mounting of securing devices
- User manuals / instructions must also provide guidelines for necessary maintenance and inspection of securing devices
- Secondary securing wire rope slings should be equal to or greater than the WLL (SWL) of the head fitting of umbilical roller sheave.



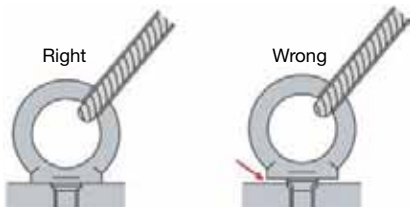
Eye Bolts and Eye Nuts

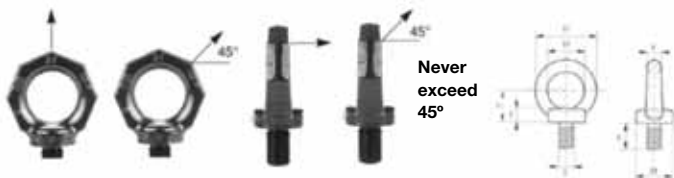
Commonly known as Lifting Eyes, eye bolts are available in a wide range of types, sizes and material options. Eye bolts should be at least Grade 80 and clearly labelled with the permitted loading and least advantageous direction.

BEST PRACTICE RECOMMENDATIONS:



- Eye bolts / eye nuts must be of an adequate WLL (SWL), certified and approved, ie designated with the current colour code
- Eye bolts / nuts must only be used for their intended purpose and manner
- The user must be familiar with the applicable limitations and guidelines for use
- Eye bolts / nuts must be adequately tightened prior to use
- Manufacturer installed eye bolts / nuts are normally appropriate for use during installation/removal of the units they are installed on, eg gear boxes, pumps, motors and valves
- Eye bolts / nuts must be removed after use, and the threads in the equipment on which they have been used must be preserved, eg by grease and a plastic plug.





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Hanging Hoses and Service Loops

Securing hanging hoses, in particular jet water hoses, presents a safety problem. Use of clips and chains has proven unsatisfactory. With their many parts, the clamps themselves constitute a snagging / dropped object risk. Incorrect positioning of clamps and chain loops that are too long have resulted in breakage / bursting and hoses falling.

BEST PRACTICE RECOMMENDATIONS:



- The equipment manufacturer's instructions for installation and the technical description must be followed
- Clamps must be attached and securely fastened at the point where the hose is labelled "Attach safety clamp here"
- Safety chains must be as short as possible and installed as close to the vertical as possible in order to prevent fall energy and pendulum effect
- Securing devices for hoses must be designed to support the maximum loads generated by a burst hose
- The required resistance to wear and tear, chemicals, heat and UV radiation must also be documented
- The securing system for hoses must be documented and traceable
- The securing devices should be checked and labelled in accordance with the norm for lifting appliances
- In addition to correct instructions for installation, the user manual /maintenance instructions should contain guidelines for necessary maintenance and inspection of the securing devices
- Where Hammerlok chain connectors are used, ensure appropriate grade is selected and installed by a competent person.



Grating and Hatches

At present, there are a number of different ways of fastening grating to underlying structures or frames. As a result of vibration and defective locking of fastenings, there are numerous incidents or loose grating or loose / missing fastening clips.

BEST PRACTICE RECOMMENDATIONS:



- Grating must be adequately fixed to underlying structures with fastenings that do not loosen with vibration or loads
- Through bolts or threaded connections are recommended for fastening
- Fastening clips must consist of as few parts as possible
- Openings in the grating must not exceed 20mm / 3/4in
- If grating is cut out and reinstalled by welding, the contact surfaces must be cleaned and/or polished to remove galvanisation and to ensure clean steel surfaces and adequate adhesion
- If large areas are cut away, a special frame must be installed and the necessary underlay calculated.

Hatches and access panels present dropped object hazards due to improper use, lack of inspection and maintenance and general lack of awareness.

BEST PRACTICE RECOMMENDATIONS:



- Ensure all hatches and access panels are correctly seated and secured from dropping
- Regularly inspect hinges and lugs for corrosion and wear
- Where possible, apply safety wire to provide additional securing.



Piping and Equipment Feedthroughs

Throughout the industry, we have identified significant short-comings in piping equipment feed-throughs, often where hole covers are missing.

BEST PRACTICE RECOMMENDATIONS:



- All piping and equipment feedthroughs in decks and grating must have a toe board and must be covered to the greatest extent possible
- Canvas or a cladding material can be used. This is especially important in areas where there is equipment requiring periodic maintenance
- High visibility rigid products such as Gapguard are available.



PIPE CLAMPS

Pipeclamps are prone to vibration and corrosion, resulting in components becoming loose and dislodged.

DROPS recommends that all pipeclamps are regularly inspected for fatigue, missing components (brackets, bolts, locking wire, tab washers) and effects of constant vibration.





Guard Rails

Major defects have been observed with guard rails, in particular collapsible and movable Guard rails.

BEST PRACTICE RECOMMENDATIONS:



- Guard rails must be a minimum of 1100mm / 3ft 6in high and have integrated toe boards that are at least 100mm / 4in high
- Guard rails must be functionally designed for the area they are intended to secure, eg safety mesh should be installed as required (loading areas)
- Guard rails shall not have deformations or cracks that affect their functionality or strength
- It must always be possible to insert movable guard rails into the fastenings and insert a securing through-bolt
- The safety bolt must be adequately locked using a securing pin, snap hook (with eyelet) or a split pin
- Both the safety bolt and locking mechanism must be secured in the immediate vicinity of the fastening
- All connections between elements in the railing must be secured with a through-bolt and locking nut
- The use of setscrews is not recommended in permanent guard rails
- Guard rails and attachment points for collapsible and movable guard rails must be inspected on a regular basis to maintain adequate security and functionality
- Safety barricades and mesh systems may be applied to reduce potential for items to fall through guard rails. These should be of suitable materials, incorporate appropriate safety securing features and be installed and maintained in accordance with manufacturer's recommendations.



Toe Boards

Missing and incorrectly installed toe boards are regularly observed. Often, the gap between the toe board and the deck exceeds requirements.

BEST PRACTICE RECOMMENDATIONS:



- Decks, gangways and platforms must have toe boards at least 100mm / 4in high
- On stairways, every step must have a toeboard at least 50mm / 2in high
- All landings in stairways must have toe boards at least 100mm / 4in high
- The gap between the deck or grating and toe board must not exceed 10mm / 3/8in
- When removing guard rails temporarily, the checklist must include reinstallation of toe boards in accordance with the applicable rules and regulations.



Swing Gates

Many swing gates have been found to have hinges with neither the necessary quality of material nor the design strength to serve their intended function over time. Many older gates also lack integrated toe boards.

BEST PRACTICE RECOMMENDATIONS:



- Wherever possible, the hinges must form an integral part of the gate – ie they should be welded on
- Removable gate hinge pins must be fitted with secondary retention eg split pin
- Gates must open / swing inwards to the platform or deck
- Gates must be at the same strength as surrounding guard rails
- Gates must be secured against becoming disengaged
- Gates must be designed to automatically return to and remain in the closed position
- On floating rigs, the use of locking fingers should be considered so that the gate can be locked in the closed position
- Where possible, toe boards should be integrated in gates
- Swing gates must be inspected and maintained on a regular basis to ensure adequate function
- Where flip-over / drop-down gate rails are fitted, these must be secured with secondary retention eg split pin and where necessary secured with safety wire.



Flip-over / drop-down gate mechanisms can become dropped objects. As such, self-closing gates eliminate this hazard and would be recommended where practicable.



REMOVABLE GATE HINGE PINS

Must be fitted with secondary retention eg split pin.

Ladders

Safe use of ladders in the workplace is governed by Work at Height Codes, Standards and Regulations applicable in your region.

However, many cases have been found of damage to ladders and safety cages as a result of collisions with mobile equipment. In addition, cracks have been found in safety cages, especially in derricks, leading to dropped object incidents.

BEST PRACTICE RECOMMENDATIONS:



- Ladders and safety cages must be inspected on a regular basis
- Anti-fall device equipment and turntables must be regularly inspected for damage / loose fittings
- Safe landing or rest platforms must be regularly inspected for loose items and all gates, removable rails and gratings checked to ensure all fastenings are secure and in place
- Any damage and deformation must be reported and corrected as soon as possible.



When using fixed ladders with 'back scratcher' safety cages, always consider potential for snagging of personal tools and equipment as this can cause items to fall.



Wind Walls

Many cases of damage and loose panels have been found in wind walls. This is presumably due both to faulty installation and to external factors (collisions with mobile equipment and exposure to wind and weather).

BEST PRACTICE RECOMMENDATIONS:



- The type and method of attachment should be chosen in accordance with the manufacturer's instructions. The preferred solution is through-bolts with locking nuts
- Wind-wall panels must be fastened to a separate support / structure and never to the main structure
- Wind wall panels must always be reinforced by horizontal steel beams in accordance with the design loads
- Areas that are exposed to collision risk must have stronger corner mountings secured by through-bolts and locking nuts
- The manufacturer must provide guidelines for installation, necessary maintenance and inspection of wind-wall panels and attachment.



Ensure that all fastenings are installed as per manufacturer's instructions. Inspect all fastenings on a regular basis.

Ensure all externally mounted equipment such as lamps and signage are inspected regularly and report all signs of damage or corrosion.



Signage

BEST PRACTICE RECOMMENDATIONS:



Ideally, signage should be painted directly upon structure. Where this is not possible:

- Signs must be securely attached so as to ensure that they do not accidentally come loose and fall down
- Brackets and frames for signs must always be securely attached
- Where the underlying material permits, sign frames should be attached using through-bolts
- Fasteners used for attachment to brackets and structures must be fitted with secondary retention
- Identification labels that are painted or stuck on are recommended for identification of pipe systems. If the temperature precludes this, identification labels should be attached with steel tape.



Signage should be ideally stencilled



Cladding

There have been many instances within the industry where pieces of insulation cladding have dropped from height due to vibration, corrosion or strong winds.

BEST PRACTICE RECOMMENDATIONS:



- Insulation cladding must be securely fastened to prevent locks from loosening unintentionally
- The locks should be secured with secondary retention, either by using a bolt and locking nut or by inserting a stainless split pin / cotter pin through the securing holes in the locks or similar
- Maintenance routines must include inspection of the cladding to ensure that it is in good condition.



Floodlamps

Many floodlights installed at height are not adequately secured against falling or colliding with mobile equipment.

BEST PRACTICE RECOMMENDATIONS:



- Floodlights must be positioned to avoid collision with loads or equipment.
- Floodlights must be equipped with two independent barriers. The attachment points must be integrated, eg eye bolts threaded into the floodlight housing where applicable or as per manufacturer's recommendation
- Brackets must be fitted with secondary retention
- Hatches for exchanging light bulbs must be hinged or secured with wire to the floodlight housing
- Floodlamps positioned at height and assessed to be at risk of failure due to dynamic forces should be fitted with safety nets, particularly where multiple components are identified
- Calculations must be available for attachment points and securing devices, relating to the relevant fall energies
- User manuals / instructions must provide guidelines for the correct mounting of securing devices
- User manuals / instructions must also provide guidelines for necessary maintenance and inspection of securing devices.



Where potential exists to incorporate additional safety securing wires or nets and any associated securing points such as eye bolts, ensure that these modifications do not compromise the function, integrity and rating of the electronic fitting.



Safety Nets (see page 20) are widely used in providing safety securing for 'at risk' equipment located at height.



Light Fittings

BEST PRACTICE RECOMMENDATIONS:



- Lighting fixtures must be positioned to prevent them being hit by mobile equipment / loads
- Lighting fixtures and brackets should be fitted with secondary retention
- Attachment points for safety wires should be integrated at both ends of the fixture
- Battery packs must be fitted with secondary retention
- Light fittings positioned at height and assessed to be at risk of failure due to dynamic forces should be fitted with safety nets, particularly where multiple components are identified
- Above walkways and other trafficked areas, fixtures to which power is supplied from one side only should be secured at the opposite end with a safety wire
- The cover should have steel hinges that can be attached on either side
- Plastic components should be avoided, since over time they are weakened by UV radiation
- On existing, older types of fixtures, covers should be secured using stainless tie wraps or galvanised perforated steel band
- The component rail should be hinged and must be able to be properly secured in the closed position
- The strength of attachment points and securing devices should be evaluated in relation to the relevant fall energies
- For new installations, or when installing securing devices on existing equipment, an up-to-date user manual / maintenance instructions should be provided.



Where potential exists to incorporate additional safety securing wires or nets and any associated securing points such as eye bolts, ensure that these modifications do not compromise the function, integrity and rating of the electronic fitting.



Navigation Lights

Several types of navigation light used on our facilities are frequently found to be inadequately secured against falling.

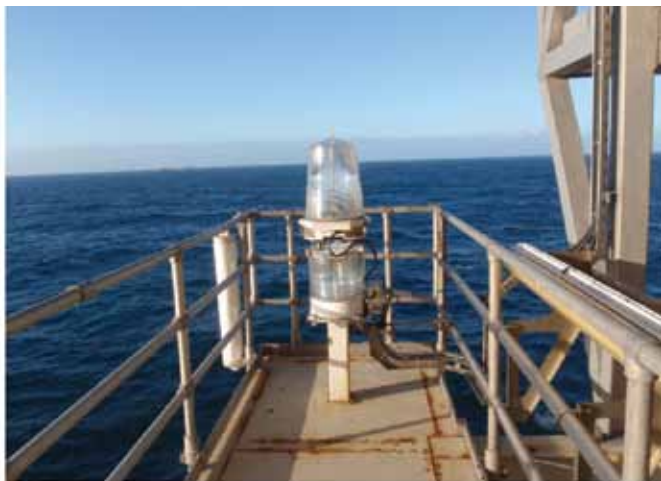
BEST PRACTICE RECOMMENDATIONS:



- The bolts used for mounting brackets to structures must have secondary retention
- Attachment brackets must have holes for fastening safety wires
- Covers must be hinged or have internal safety wires
- Hatch covers for electrical connections must not be completely removable
- Calculations must be made for attachment points and securing devices, relating to the relevant fall energies
- Navigation lights with sliding grooves for bolt attachment are not recommended
- Lights positioned at height and assessed to be at risk of failure due to dynamic forces should be fitted with safety nets, particularly where multiple components are identified
- User manuals/instructions must provide guidelines for the correct mounting of securing devices
- User manuals/instructions must also provide guidelines for necessary maintenance and inspection of securing devices.



Where potential exists to incorporate additional safety securing wires or nets and any associated securing points such as eye bolts, ensure that these modifications do not compromise the function, integrity and rating of the electronic fitting.



CCTV Cameras (Integrated Solution)

Within the industry, it is identified that CCTV cameras have been inadequately secured and can present snagging hazards.

BEST PRACTICE RECOMMENDATIONS:



- CCTV camera location must be evaluated to prevent risk of contact with moving equipment / loads
- In areas where there is crane activity, cameras should be shielded by protective cages
- The camera casing must be fastened to the bracket and structure with adequate locking of attachment bolts
- The attachment point for securing devices should form an integrated part of the camera casing and bracket
- Strength of attachment points and securing devices, related to the relevant fall energies must be evaluated
- For new installation or when installing securing devices on existing equipment, a user manual / maintenance instructions should be available. The instructions should also cover securing devices.



CCTV Cameras (Non-integrated Solution)

CCTV cameras are subject to dynamic forces, particularly snagging. Lens covers, wipers and motors frequently fall to the deck below due to collisions or loose fittings.

BEST PRACTICE RECOMMENDATIONS:



- CCTV camera location must be evaluated to prevent risk of contact with moving equipment / loads
- Where there is danger of the camera being struck by mobile equipment/loads, it must either be protected by a reinforced cage or be fitted with safety wire to structure
- The camera should be fitted with two independent barriers on the camera casing, the motorized pan-tilt zoom unit, the wiper motor and the lens cover
- The camera casing and motorized pan-tilt-zoom unit should be attached to the bracket and structure with adequately locked attachment bolts
- The attachment point for the securing devices should be integrated into the camera parts. Alternatively special clamps can be used as attachment points
- Calculations must be available for attachment points and securing devices, related to the relevant fall energies
- For new installations or when installing securing devices on existing equipment, a user manual / maintenance instructions should be available. The instructions should also cover securing devices.



Crane Boom Camera and Pivoting Floodlamps

Pivoting equipment attached to crane booms are exposed to considerable shockloading, vibration and cyclic motion factors which can, if unchecked, lead to fatigue and failure of pivot fixings.

BEST PRACTICE RECOMMENDATIONS:



- Crane boom cameras and floodlights must have two independent barriers. Unnecessary lighting should be removed
- Bolts used for attaching the crane boom camera / floodlight to brackets and structures must be fitted with secondary retention
- Attachment points for the safety wire / chain shall be an integrated part of the camera / floodlight casing. Alternatively, special clamps can be fitted around the camera casing
- The safety wire must run from the camera casing through the camera bracket and then through the attachment bracket before being securely attached to the crane boom structure
- On floodlights, the glass frame and any protective cages should be hinged or otherwise secured
- Calculations relating to the relevant fall energies should be available for attachment points and securing devices
- For new installations, or when installing securing devices on existing equipment, an up-to-date user manual / maintenance instructions should be provided.



The crane boom camera and floodlight, securing devices and attachments should be regularly inspected in order to identify any fatigue, corrosion or loose fittings.

The pivot bolt and all attachment brackets must also be included in the inspection routines, with particular attention afforded to the primary fixing to the main boom structure and/ or the quality and design of the pivot device.



PA Loudspeakers

There have been several cases where we have discovered loose screw connections between loudspeakers and attachment braces / brackets.

BEST PRACTICE RECOMMENDATIONS:



- Loudspeakers must be fastened to the brackets in a manner that permits adequate locking of attachment bolts
- Loudspeakers must be placed where they are not at risk of being hit by mobile equipment
- If there is a risk of being hit by mobile equipment, loudspeakers must either be protected by reinforced braces or equipped with a safety wire
- Calculations must have been made and be available for attachment points and securing devices, relating to the relevant fall energies
- User manuals / instructions must provide guidelines for the correct mounting of securing devices
- User manuals / instructions must also provide guidelines for necessary maintenance and inspection of securing devices.



Junction Boxes and Cabinets

Several risk factors have been discovered relating to the incorrect location of junction boxes and cabinets, to defective suspension / fastening and to inadequate securing of hatches, doors and covers.

BEST PRACTICE RECOMMENDATIONS:



- Junction boxes and cabinets must be located where they do not obstruct passage ways, evacuation routes or mobile equipment
- The type and design of suspension / fastening must take account of calculated loads and known potential external stress factors
- Hinged hatches / doors must be secured against unintentional disengagement and the locking device must have two barriers against opening
- Large detachable hatches on machinery at height, and inspection hatches must be secured by a wire / chain
- Covers must be secured by screws that are secured / locked to prevent unscrewing or by the cover being secured with an internal wire or chain
- The securing device must be designed to support the relevant loads.



Ensure all loose items are removed from junction boxes after routine maintenance.



Cable Trays and Ladders

Many instances have been discovered of loose nuts and bolts in the joints and fastenings of cable ducts (electro-steel), probably as a result of vibration and / or faulty installation.

BEST PRACTICE RECOMMENDATIONS:



- Only bolted connections that have been approved by the supplier of the cable support system may be used for fastening and joining
- Pipe clips must have an adequate screw connection for functional locking
- When attaching the cable support system to a structure, the risk of galvanic corrosion must be assessed and insulation considered where appropriate
- Calculations must be available for the attachment point and necessary tightening force
- The user manual / instructions must also provide guidelines for correct installation, both in the joints and the attachment
- In addition, the user manual / instructions must provide guidelines for necessary maintenance / retightening and inspection of both electro-steel and bolt and screw connections.



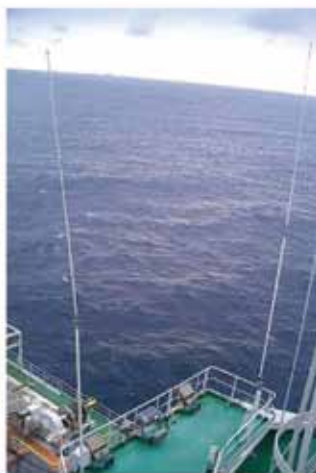
Antennas, Windsocks and Sensors

Typically, these communications and meteorological instruments are mounted at height and are exposed to continuous environmental forces. There have been several reported incidents where such items – or individual components have become dislodged and fallen considerable distances.

BEST PRACTICE RECOMMENDATIONS:



- All fasteners and U-bolt fasteners shall be secured against loosening
- Two U-bolt fasteners or a minimum of three fasteners shall always be used
- All bolts shall be through-bolts – do not use set screws
- All heavy antennas should be installed with additional safety securing, such as wire or chain
- Stay wires can be used for stability in accordance with the supplier's specifications. All fasteners must be secured
- Avoid long whip antennas if possible, stretched antennas can be used as an alternative
- Wind sensors with moving parts should be replaced with ultrasonic wind sensors
- Fibreglass whip antennas should be replaced every five years
- All equipment and securing devices shall have routines for preventive maintenance which include the supplier's recommendations and best practices.



Valve Wheels and Handles

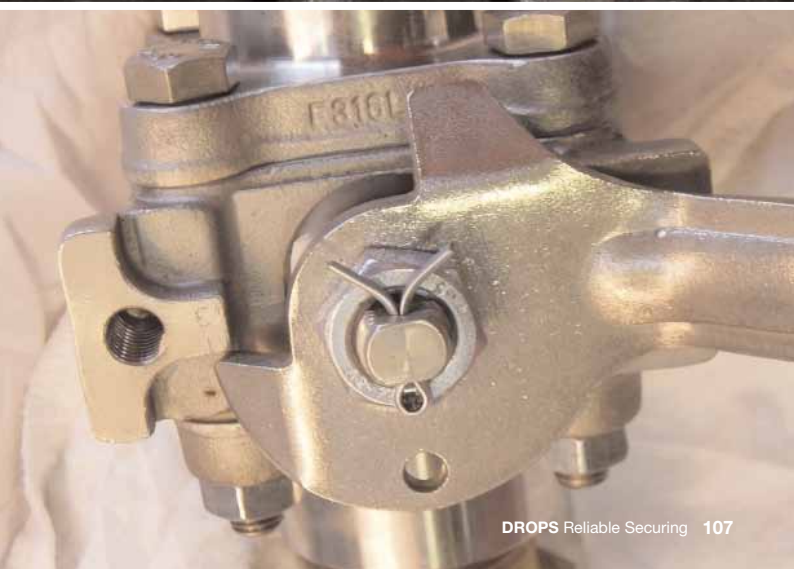
Many cases have been discovered where valve wheels and valve handles for manual stop valves are not adequately secured.

BEST PRACTICE RECOMMENDATIONS:



- Valve wheels and handles must have two independent barriers
- Where possible, nuts and split pins should be used in the valve stem on stationary valve handles and wheels. On large handles and wheels bolts and locking nuts should be used instead of split pins
- When mobile handles and wheels are used, they should be secured by a bolt, or locked by a split pin, through the valve stem
- During storage, handles and wheels must be adequately secured against falling
- If Seeger rings are used for locking / securing, frequent inspections must be made to check for corrosion and / or mechanical damage.





Chain Operated Valves

Chain-operated valves without adequate secondary retention can represent a significant risk to the operator of the valve, in particular those located at height, or in areas that are difficult to access.

There are several different types and designs of chain-operated valves available on the market, but the principles for securing these valves will be the same in most cases.

BEST PRACTICE RECOMMENDATIONS:



- The valve wheel shall be attached to the valve stem with locked through-bolt connections, eg castle nuts with split pins
- In cases where the chainwheel is installed on an existing valve wheel, the chainwheel must be fixed to the valve wheel with U-clamps fitted with secondary retention
- If the chain guides are installed with a surface locking ring with clamping sleeves, the clamping sleeves should be replaced with bolts and locking nuts where possible. For chain guides designed with separate clamps, locked through-bolt connections must be used on the clamps
- The valve shall be secured to the structure using correctly dimensioned safety wire and lockable connectors. In many cases it will be appropriate to attach the safety wire to the chain guide on the chainwheel so that functionality is ensured (this presumes that the guide is sufficiently dimensioned and installed using locked bolt connections)
- If it is not possible to attach the safety wire to the structure via the chain guides or another method without functionality being impaired, a swivel device for the attachment of securing devices must be installed. This should only be done by qualified personnel with experience of securing such equipment at height
- For new installations, or when installing securing devices on existing equipment, an up-to-date user manual / maintenance instructions should be provided.



Cargo Inspections

Several serious incidents have occurred relating to the use and dispatch of carriers (containers, baskets, tanks etc).

BEST PRACTICE RECOMMENDATIONS:



- Chain slings must have the necessary certification, be intact, without twists and shackles and equipped with nuts and split pins
- Carriers must have the necessary identification and certified lifting lugs. Lifting lugs, doors, hinges and locks must not be deformed or damaged
- Permitted loads in containers and baskets must be well distributed and adequately secured by stamping, use of lashing rings, lashing and nets (baskets). Lashing rings must not come into contact with sharp edges and padding should be used where appropriate. Heavy objects must be placed at the bottom
- Tanks must have secured and sealed manholes / valves. All attached equipment (grids, covers, plates etc) must be adequately secured. The permitted load must not be exceeded
- On carriers with attached equipment such as pumps, tanks, winches etc check to ensure no equipment protrudes from the frame
- It must be ensured that there are no loose objects in the forklift pockets or on top of the carriers or loads
- Documentation must be checked out (signed) before transport to and from locations.



Best practice recommendations for inspection of cargo applies across all logistical activities, particularly during infield transit and back loading to shore.

Typical landing sites for potential dropped objects



***Forklift pockets, rails and roof.
Handles, lugs, panels, louvers.***



***Forklift pockets, frame and roof.
Hatches, grating, caps and panels***



***Forklift pockets, frame and tops
Remove temporary signage***



***Remove snow, ice or other debris
Adds weight, creates dropped object
hazards, obscures other loose items***

Storage of Cylinders

Gas cylinders temporarily stored are often poorly secured with rope or cargo straps.

BEST PRACTICE RECOMMENDATIONS:



- Storing of gas cylinders must not obstruct passageways or escape routes
- Gas cylinders must be stored and secured safely
- Storing of gas cylinders must be risk assessed
- Temporarily stored gas cylinders must be secured with a chain
- Permanent storage racks must be equipped with securing brackets / chains.



Always maintain secure fastening on all bottles whilst in storage. These are top-heavy and can easily be toppled.

Remember adverse weather conditions can affect the integrity of bottle racks during loading and transportation. Always load partly full gas racks with bottles towards crash barriers / away from walkways.



Storage rack with bolted cylinder brackets



Temporary storage, secured with chain

Racks and Shelving

The design of racks for storage of material and equipment is often not appropriate to ensure safe storage.

BEST PRACTICE RECOMMENDATIONS:



- Ensure that temporary storage in modules is permitted in a controlled manner with respect to type of goods, duration, storage area and house keeping
- Storage must not obstruct accessibility or evacuation of the module
- Ensure that the stored materials do not obstruct access to emergency equipment
- Storage racks and storage areas must be designed to ensure that equipment cannot accidentally drop to lower levels
- The heaviest equipment should be stored lowest
- On mobile units, temporary storage space / racks must be seafastened and shelves shall be equipped with baffle plates.



Whilst it is imperative to consider the potential for items stored on shelving to fall, always assess the integrity, load limitations, stability and fastenings on all free standing or wall-mounted shelving to ensure appropriate securing has been applied.

It is advisable to regularly inspect shelving systems for heavy material storage for signs of damage, overloading or fatigue.



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This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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This image shows a full page of white paper with horizontal dotted lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Moving catwalk machine, tag line snagged handrail which fell 3m

Section of ventilation ducting (500kg) dropped 8m onto walkway below

Using tong head (42kg) as tugger counter-weight, attachment point failed; head fell 6m to rig floor

18kg Floodlight fell 20m to rig floor...

Sling parted lowering choke hose (1715kg) through rotary table, hose fell 43m into sea.

Redundant light fitting (25kg) fell 3.5m after being struck by scaffolding pole.

Tag line snagged torque wrench (7.4kg), knocking it off lower riser assembly.

Low-torque valve (43 kg) from completion string dropped 24m to skid deck.

Large spanner :1.26kg dropped 7m from scaffolding to deck.

Whip-line limit switch detached from crane, falling 45m to deck of vessel

Motor (208kg) falls 2m during lifting.
Nylon sling melted by turbine exhaust gas.

Bumper bar (10kg) detached from racker & fell 25m to rig floor.

Stacking blank flange :31kg it slipped between handrail and kick plate, falling 4.7m to stairway below.

Scaffold board :4.8kg dislodged by helicopter downdraft & fell to deck 10m below.

Ceiling panel & emergency lighting unit (18kg) fell 2.2m.